Snow lovers

Column 407
by Sarah Locke

What do lynx and caribou, arctic fox and snowshoe hares, collared lemmings and willow ptarmigan all have in common? These Yukon animals are all chionophiles, meaning snow lovers. They thrive in winter.

They evolved in the North, and have adaptations such as large snowshoe-like feet or white winter coats that allow them to survive more easily in a snow-covered land.

"Chion" is Greek for snow, and the term chionophile was coined in the 1940s by the Russian ecologist Alexander Formozov. While not in widespread use these days, the term profoundly affected the work of the Canadian dean of winter ecology, William Pruitt, who first came across Formozov's classifications while working as a post-doctoral student.

A willow ptarmigan prepared for winter in its white plumage.
(photo: Bert Katzung)

"The human mind cannot think about an object or a phenomenon unless there is a name or some way of identifying it, of circumscribing it, of giving it boundaries," writes Pruitt, in a tribute to Formozov. Pruitt went on to learn Russian so that he could better study Formozov's work.

Now a retired professor of zoology at the University of Manitoba, Pruitt describes caribou as the classic chionophiles. "The whole beast is a bundle of adaptations for winter, some for snow, some for low temperatures and some for specialized food," he says. "Anywhere from two-thirds to three-quarters of their life cycle is spent wading or digging through snow."

Hollow compartments in their guard hairs trap air, helping to insulate caribou in winter. Their large hooves act as snowshoes and allow them to dig more easily through the snow for lichens, their main winter food, which they can smell underneath the snow.

Another chionophile, the collared lemming -- the tiniest mammal in the Arctic -- turns totally white in winter and grows enlarged claws on its forefeet, presumably for digging through the snow. In winter they live in the subnivean space of the snowpack, building extensive runways and nesting areas close to the ground where it is warmest.

David Henry, a conservation ecologist with Kluane National Park, likes to look at which animals have developed the best "snowshoes" for winter travel, meaning the lowest ratio of body weight to foot surface area.

"The snowshoe hare or ptarmigan might come to mind, but it is actually the wolverine," he says. Last March he had the chance to follow the tracks of several wolverines from an airplane while working in Old Crow Flats. "Some of them just walked completely across the map sheet, from one side to another, and kept on going. That is pretty impressive. In many mountain areas, as soon as a crust forms, they start traveling long distances searching for food."

Wolverines are relatively small -- about 15 kilograms on average -- but their luxurious coats keep them warm, and are the preferred parka ruff for many Northerners; the wolverine's long straight guard hairs make its fur exceptionally frost-resistant.

In Henry's book "Canada's Boreal Forest," published by the Smithsonian Institution, he describes red squirrels as a "borderline species" in winter. Their small size means that they cannot stay out in the cold air when temperatures plummet. "If it is colder than minus 30 for a couple of days, the red squirrels must seek out cover and often go under the snow so that they can cope with the temperatures. It's a marker; when you don't hear them, you know that the temperature has dropped," he adds.

In the Russian classification system, red squirrels are chioneuphores, or snow tolerators, as are moose, wolves, red foxes, many voles, shrews and a range of other species. Henry would like to see more research on some of these animals, which do not seem well equipped for frigid conditions but still survive.

For example, chickadees drop their core temperatures when temperatures plummet, and have been observed snuggling together in tree cavities, but Henry thinks they must have other coping mechanisms as well. "As to how these animals with so much surface area survive the severe cold, I think there is more to be learned," he says.

Liz Hofer, senior technician for the Kluane Ecological Monitoring Project, is also impressed by red squirrels in winter. "They do not thermally regulate well at all. This is a problem even in summer when they are in the traps for handling or censussing purposes."

"You either store fat or store food to survive northern winters, and these spruce monkeys rely on their ability to find and maintain a midden with ideal conditions. When it's cold, they just go from warm grassy nest to underground caches and minimize exposure."

She says that one of the simplest winter adaptations -- changing colour -- continues to impress her as it takes lots of energy to grow a new coat. Lemmings, snowshoe hares and ptarmigan -- all chionophiles, all prey species -- share this strategy.

Ptarmigan also grow more feathers around their nostrils and feet in winter. The feathers around their claws form better "snowshoes" as well as adding insulation. Willow ptarmigan will fly into snow banks and nestle in the snow to sleep and stay warm. Hofer describes how this strategy once gave both her and her dog team a

much-needed shot of adrenalin at the end of a long trip, when everyone was starting to drag.

"I really wanted to get home that night, so I used a trick I reserve for such moments. I shout "Ptarmigans!" because of the way they explode out of their holes when you happen upon them sometimes. I always shouted so that I could get the same effect, but this time, a big flock of those white birds did erupt from the snow bank and I got a free ride home from the dogs. It is hard to say whose heart rate increased the most -- mine or my teams."

Pruitt's tribute to Formozov can be read online at http://herba.msu.ru/russian/journals/bmsn/104/1999_5_res.html.

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